We claim:

1. A method of producing nanostructured lithium metal phosphate of the formula, $LiFe_xM_{1-x}PO_4$, where $1 \leq x \leq 0.1$ and M is a metal cation and having an olivine structure, comprising the following steps:

(a) dispersing iron hydroxide nanoparticles coated with a anti agglomeration molecule in a liquid solution,

(b) at least one of the steps of :1) dissolving a metal salt in the liquid solution and 2) dispersing metal oxide nanoparticles in the liquid solution,

(c) dissolving a phosphate ion containing chemical precursor in the liquid solution,

(d) dissolving a lithium containing salt in the liquid solution,

(e) heating the solution to promote the precipitation of $LiFe_xM_{1-x}PO_4$ precursor material, and

(f) evaporating the liquid and heat treating the solids for removing volatiles and forming the olivine structured $LiFe_xM_{1-x}PO_4$ compound

2. The method as claimed in Claim 1, wherein the metal salt is selected from the group consisting of: metal nitrate, metal carbonate, metal acetate, metal chloride, metal 2,-4 pentanedionate, metal formate, metal oxalate and metal alkoxides.

3. The method as claimed in Claim 1, wherein primary particle size of metal oxide nanoparticles is in the range of 5 – 100 nm, and the average secondary (aggregate) particle size is in the range of 25 – 1000 nm.

4. The method as claimed in Claim 1, wherein the phosphate ion containing chemical precursor is selected from the group consisting of : ammonium hydrogen phosphate, ammonium dihydrogen phosphate, ammonium phosphate, orthophosphoric acid, lithium dihydrogen phosphate, sodium hydrogen phosphate, sodium dihydrogen phosphate, di-(2-ethyhexyl)phosphoric acid.

5. The method as claimed in Claim 1, wherein lithium salt is selected from the group consisting of: lithium nitrate, lithium hydroxide, lithium carbonate, lithium chloride, lithium acetate and lithium iodide.

6. The method as claimed in Claim 1, wherein the average primary particle size of iron hydroxide or iron oxide nanoparticles is in the range of 5 – 100 nm.

7. The method as claimed in Claim 1, wherein the liquid solution is heated at a temperature in the range of 30 – 100 °C.

8. The method as claimed in Claim 1, wherein the solution is heated for a period in the range of 1 – 24 hrs.

9. The method as claimed in Claim 1, wherein the heating step is conducted at an atmospheric pressure in the range of 0.5 t o10 atmosphere.

10. . The method as claimed in Claim 1, wherein M is selected from the group consisting of Mn, Co, Ni, and V.

11. The method as claimed in Claim 1, wherein the dried solid as collected in Claim 10 is calcined at a temperature in the range of 200 – 600 °C for removing volatiles.

12. The method as claimed in Claim 11, wherein the solid is calcined for a period in the range of 1 – 48 hrs in at least one of: an oxidizing atmosphere and an inert atmosphere.

13. The method as claimed in Claim 12, wherein the calcined $LiFe_xM_{1-x}PO_4$ powder is heat treated at a temperature in the range of 400 – 800 °C.

14. The method as claimed in Claim 13, wherein the calcined $LiFe_xM_{1-x}PO_4$ powder is heat treated in an inert atmosphere for a period in the range of 1 – 48 hrs.

15. A method of producing nanostructured lithium metal phosphate/C composite poowder of the formula, $LiFe_xM_{1-x}PO_4/C$, where $1 \leq x \leq 0.1$ and M is a metal cation, comprising the following steps:

(a) dispersing $LiFe_xM_{1-x}PO_4$ nanoparticles in a liquid solution

(b) dissolving a metal catalyst salt to the liquid solution

(c) evaporating the liquid and heat treating the solid in a reducing atmosphere for coating metal catalyst on the surface of $LiFe_xM_{1-x}PO_4$ nanoparticles, and

(d) carbonizing the metal coated $LiFe_xM_{1-x}PO_4$ nanoparticles in a reducing atmosphere.

16. The method as claimed in Claim 15, wherein the metal catalyst salt is selected from the group consisting of: metal nitrate, metal carbonate, metal acetate, metal chloride, metal 2,-4 pentanedionate, metal formate, metal oxalate and metal alkoxides.

17. The method as claimed in Claim 15, further including the step of separating the solid particles from the a liquid by at least one of the following methods: filtration, evaporation and centrifuging.

18. The method as claimed in Claim 15, wherein the dried solid as collected in Claim 17 is heat treated in a reducing atmosphere at a temperature in the range of 200 – 800 °C for reducing the metal catalyst salt.

19. The method as claimed in Claim 18, wherein the solid is heat treated for a period in the range of 1 – 5 hrs in a reducing atmosphere.

20. The method as claimed in Claim 15, wherein the dried powder as prepared in Claim 18 are carbonized in a reducing atmosphere at a temperature in the range of 400 – 1000 °C.

21. The method as claimed in Claim 20, wherein the solid is heat treated for a period in the range of 1 – 48 hrs in a carburizing atmosphere.

22. The method as claimed in Claim 20, wherein a gas containing a mixture of H_2 and a vapor carbon source is used in the carbonizing step.

23. A method of producing nanostructured lithium phosphate, $LiFePO_4$, having an olivine structure, comprising the following steps:

a) dispersing iron hydroxide nanoparticles coated with a anti agglomeration molecule in a liquid solution,

b) dissolving a phosphate ion containing chemical precursor in the liquid solution,

c) dissolving a lithium containing salt in the liquid solution,

d) heating the solution to promote the precipitation of $LiFePO_4$ precursor material, and

e) evaporating the liquid and heat treating the solids for removing volatiles and forming the olivine structured $LiFePO_4$ compound.

24. The method as claimed in Claim 23, further including the addition of metal cation by the at least one of the steps of :1) dissolving a metal salt in the liquid solution and 2) dispersing metal oxide nanoparticles in the liquid solution; after step a) to form a $LiFe_xM_{1-x}PO_4$ compound, where $1 \leq x \leq 0.1$ and M is the metal cation.

25. The method as claimed in Claim 24, wherein M is selected from the group consisting of Mn, Co, Ni, and V.